



MACHAKOS UNIVERSITY
University Examinations for 2024/2025 Academic Year
SCHOOL OF PURE AND APPLIED SCIENCES
DEPARTMENT OF BIOLOGICAL SCIENCES

**SECOND YEAR SECOND SEMESTER EXAMINATION FOR DEGREE IN
BACHELOR OF SCIENCE IN ENVIRONMENTAL SCIENCE**

ENS 221: PRINCIPLES OF ENVIRONMENTAL GENETICS

DATE: 13TH JANUARY, 2025

TIME: 2.00 PM – 4.00 PM

INSTRUCTIONS:

- Answer question **ONE (Compulsory)** and **any other TWO** questions
- Use clean well labelled diagrams wherever appropriate

QUESTION ONE (30 MARKS)

- Summarize the “Ames Test” method of mutant screening. (3 Marks)
- Explain one application of biotechnology in the environment and the principle behind it. (3 Marks)
- Explain three structural differences between DNA and RNA. (3 Marks)
- With an illustration, highlight the components of a nucleotide. (3 Marks)
- Explain the difference between a lagging strand and a leading strand. (3 Marks)
- Explain why the pea plant was preferred in Mendel’s experiments. (3 Marks)
- Describe the relationship between phenotype, genotype and heterozygosity. (3 Marks)
- Explain the percentage composition of bases in strand 2 of a DNA, when strand 1 has 24 % Adenine and 28 % Thymine. (3 Marks)
- Explain three differences between mRNA and tRNA. (3 Marks)
- Describe three types of point mutations. (3 Marks)

QUESTION TWO (20 MARKS)

- a) Discuss the environmental risks of genetic modification. (10 Marks)
- b) Describe an experiment to prove that DNA is the genetic material. (10 Marks)

QUESTION THREE (20 MARKS)

Discuss the gene expression process. (20 Marks)

QUESTION FOUR (20 MARKS)

Describe five strategies of gene transfer in genetic engineering. (20 Marks)

QUESTION FIVE (20 MARKS)

- a) Describe an experiment to demonstrate that DNA replication is semi-conservative. (10 Marks)
- b) Describe a regulatory mechanism for protein synthesis where the molecule to be broken down acts as a switch. (10 Marks)